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THE LARAMIE AND FORT UNION BEDS IN NORTH DAKOTA.

WHILE considering economic problems in North Dakota and eastern Montana, abundant opportunity was given to examine the beds that in geological literature have long been known as the Fort Union, and to compare them with beds that have been assigned without question to the Laramie. From this study certain definite impressions were gained in regard to the relationship existing between the Fort Union beds and the Laramie. In stating these impressions, no effort will be made to contribute to the already abundant literature bearing on the larger question of the position of the Laramie as a whole.

The field work covered six months in the years 1902 and 1903, the area studied including the entire western half of North Dakota and eastern Montana along the Yellowstone. The unusual exposures along the Missouri throughout the three hundred miles of its course in North Dakota were examined, the trip down the river being made by boat. From the western boundary of North Dakota the river passes from beds that have been regarded as typical Fort Union, to an area that has been assigned without reserve to the Laramie. The tributaries of the Missouri from the west and the bad lands also give abundant opportunity for stratigraphic study.

Though eager to discover vertebrate remains, none were found, except great numbers of buffalo bones in the lower river terraces. Molluscan and plant fossils, however, were collected at a number of points. The molluscs were identified by Mr. T. W. Stanton, and the plants by Mr. F. H. Knowlton, of the U. S. Geological Survey, and those that seem to be suggestive in considering the relation of the Fort Union to the Laramie will be noted.

The area supposed to be occupied by the Fort Union beds has never been definitely outlined. Lesquereaux[1] states that they occupy

> the whole country about Fort Union, extending north into the British possessions to unknown distances; also southward to Fort Clarke; seen under the White River group, on North Platte River, above Fort Laramie; also on west side of Wind River Mountains.

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[1] *United States Geological Survey*, Vol. VII, p. 24.

The older reports of the United States Geological Survey locate Fort Union variously in North Dakota and Montana. The place has long since disappeared from the map, and the site is now represented by Fort Buford, which is located on the Missouri River only three miles from the mouth of the Yellowstone. The confusion in regard to states arose from the fact that the old Fort Union, while located in North Dakota, was only three miles from the Montana line.

The following sections, taken at Glass Bluffs, on the south bank of the Missouri and four miles below Fort Buford, illustrates the beds commonly designated as Fort Union.:

		Feet	Inches
	13 glacial drift	25	
	12 gravel, well rounded, fresh	4	
FORT UNION	11 clay, sandy	90	
	10 sandstone	2	
	9 clay, blue, sandy	48	
	8 clay	2	
	7 lignite, impure		3
	6 clay	4	
	5 lignite, fair quality	5	
	4 clay, hard, yellow	4	
	3 clay, fat	6	
	2 lignite, good quality, with 3 in. clay in middle	3	6
	1 yellow clay, growing sandy toward the top	35	
		228	9

Instead of being in any way remarkable, this section would serve to illustrate the prevailing characteristics of the Laramie as well as it does the Fort Union. In North Dakota, at least, there is nothing peculiar in the beds, their composition or position, that will differentiate the Fort Union from the Laramie. If a number of descriptions of Laramie sections taken from the Little Missouri country south of Medora, or north of Bismarck were written with sections from about old Fort Union, it is practically certain that the regions from which they came could not be distinguished. A large number of sections like the one just quoted, but taken from regions that have always been regarded as Laramie, have been published elsewhere.[1] In a single area, in the southern part of the state near the mouth of the Cannon Ball River and extending back from the Missouri for sixty miles, the Laramie differs from the so-called Fort Union beds about Fort Buford. As exposed along the Cannon Ball River, the Laramie is made up for the most part of sand and sandstone, while lignite is present only in thin beds, and clay is second to sand in abundance. Here, however, *Corbicula nebraskensis* M. & H. is found in abundance, which was originally reported from the Fort Union of the Northwest.

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[1] *Second Biennial Report of the North Dakota Geological Survey*, 1901–2.

Shells were found in abundance at a number of points, the following forms being frequently noted:

Viviparus trochiformis M. & H.
Campeloma multilineata M. & H.
Unio priscus M. & H.

These were found alike about old Fort Union and in the Laramie, and at various horizons.

At a number of points leaf-prints were found. Ten miles north of Minot and one hundred and twenty miles east of old Fort Union, a clay bed between two lignite seams occurs, filled with the following forms:

Sequoia angustifolia Lesq.
Sequoia Langsdorfii (Brongniart) Heer.
Sequoia brevifolia Lesq.

At least one of these forms was found at Mannhaven, eighty miles north of Mandan. Though the Fort Union has never been definitely outlined, no one seems to have extended it to these points. In these two localities the leaf-prints had a nearly common elevation of 1,600 feet, while the lowest beds exposed on the Missouri River at old Fort Union are 1,800 feet above the sea.

Near Coal Harbor, which is eighty miles north of Bismarck, at an elevation of 100 feet above the Missouri River, and both outside of and below the Fort Union beds, as they are commonly understood, a limestone layer about two feet thick occurs, which abounds in leaf prints. From this limestone the following were taken:

Credneria? daturiaefolia.
Phyllites cupanioides Newb.
Celastrus (probably).

In his note returning the fossils, Mr. R. S. Bassler, of the U. S. National Museum, to whom the specimens were sent, says: "Mr. Knowlton, of the United States Geological Survey, has kindly identified them, and says that their age appears to be Fort Union."

Phyllites cupanioides is noted in Newberry's[1] list as occurring only in the Fort Union.

As a result of two summers of field work in North Dakota, the very definite impression remains that, at least in that state, there is great difficulty in retaining the term "Fort Union beds," since they never have been, and apparently cannot be, set off from the Laramie either in vertical or horizontal extent. The conclusion of White[2] seems to be wholly justified:

> In eastern Montana and western North Dakota the Laramie strata are similarly connected, by specific identity of molluscan remains and by apparent continuity of sedimentation, with those which there are reported to bear a purely Tertiary flora, and which have generally been designated the Fort Union group.

From the standpoint of paleobotany, Clark[3] indicates that the same conclusion may be reached. He quotes Professor Newberry,[4] who held that the two formations should be referred to different horizons, the Laramie to the Cretaceous, and the Fort Union to the Tertiary. These quotations he follows immediately with others from Professor Ward, who, discussing the statements of Dr. Newberry, says:

> that, although the difference in flora exists, "yet the Laramie and Fort Union must go together," and offers in explanation "that possibly the latitude, taken in connection with a different topography, such as may have existed in the two regions, might account for the great difference in the floras." Professor Ward further gives a list of eight identical species from the Laramie and Fort Union groups.

Knowlton[5] also holds that there can be scarcely any doubt that the flora of the Upper Laramie, of the Atanekerdluk series in Greenland, and of the Spitzbergen and Alaskan territories is identical with the Fort Union flora of the Missouri region.

In mapping North Dakota, therefore, there seems to be no satisfactory reason for noting Fort Union beds as distinguished from the Laramie. Indeed, to make such a distinction seems practically impossible.

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April 30, 1904.

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[1] Monograph XXXV, *The Later Extinct Floras of North America*, p. 150.

[2] *Bulletin No. 82*, U. S. Geological Survey, p. 149.

[3] *Ibid.*, *Bulletin No. 83*, p. 135.

[4] *Geological Society of America, Bulletin*, Vol. I (1890), pp. 524–27.

[5] *Proceedings of the National Museum*, Vol. XXVII (1894), p. 240.